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Efficiency Outcomes in the IT-BPO Sector in the Philippines: A Computable General Equilibrium (CGE) Analysis Using GAMS

Zayd Derweesh June 2017

Abstract:

In less than two decades, the Philippines have emerged as a major exporter of services, particular in information technology business process outsourcing (IT-BPO). A number of factors contributed to the emergence of this sector, including a high level of literacy and human capital, the existence of high quality institutions, and the liberalization of the Philippine telecommunications sector in the early 1990s. We analyze two policy simulations designed to improve the functioning of this sector and enhance its regional competitiveness, by targeting labor and capital productivity in the IT-BPO sector.

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Introduction

In less than two decades, the Philippines has emerged as a major exporter of services, in particular Business Process Outsourcing in the tech sector (IT-BPO). A number of factors have contributed to the emergence of this sector, including a high level of literacy and human capital, the existence of high quality institutions, and the liberalization of the Philippine telecommunications sector in the early 1990s (World Bank 2011). The Philippine government will undoubtedly have an interest in building on the success already seen in this in order to enhance the Philippines' reputation among international investors as a premier location for IT-BPO services.

What is IT-BPO?

IT-BPO refers to a broad group of sub-sectors. Historically, the IT-BPO industry in the Philippines focused on call centers and lower-end back-office services. The industry entered its nascent stage in 1992, when Accenture opened up the first call center in the country (ASEAN Briefing 2015). In 1995, the government passed the Special Economic Zone Act, which provided incentives for investors to locate IT-BPO firms in special economic zones in the country (Congress of The Philippines 1995). Since then, growing competition in the telecommunications industry forced firms to invest heavily in capital in order to survive, and to meet their service commitments to the government. Between 1996 and 2002, the telecommunications industry received 11% of total FDI investment in the country (Pasadilla 2006). The subsequent two decades' revenues grew tenfold, from $1.55bn to $15.5bn in 2013, as the industry expanded into areas such as knowledge process outsourcing, IT software and services, engineering service outsourcing, and graphic design. Growth has taken place in both the lower and higher ends of the value chain, and the industry is expected to expand in other IT-BPO areas such as medical transcription, banking, and insurance (IBPAP 2012, ASEAN Briefing 2015).

How important is the IT-BPO industry?

Unlike many developing countries, the Philippines is not heavily dependent on agricultural output. Rather, some 92% of output is non-agricultural (Robinson 2013). With a population of 101 million – the 13th largest globally – of which 44% are urban, and as the third largest English speaking population in the world, the Philippines is well placed to be a hub for global services. About 75% of GDP is composed of consumption, with a further 15% being government expenditures and 10% investment. Foreign direct investment remains low compared to the country's neighbors.

The Philippines accounts for 15% of the global IT-BPO market, behind only India (37%) and Canada (27%). Export of service as a percentage of total exports grew from 9% to 21% between 1999 and 2009. Sectoral growth averaged 3.6% per year, compared to the Asian average of 1.5% per year (World Bank 2011). The service sector in general (which includes IT-BPO) has grown to be the biggest employer in the country, at 51.9% of total employment as of 2010 (see table 1 below). By contrast, employment in agriculture has been steadily shrinking, and as of 2010 employed 33% of the population. Lito Tayag, member of the Board of Trustees and the Vice Chairman of the Information Technology and Business Process Association of the Philippines (IBPAP), has broadly laid out goals for the

IT-BPO sector by 2022. He stated that industry revenues could reach $38.9bn, up from $22.9bn in 2016, increasing global market share to 15.5% (Rodriguez, 2016).

Table 1: Employment in millions and % of total, by sector

Indicator	1998	2004	2005	2006	2007	2008	2009	2010
Number employed (million)								
Total employed	26.6	31.3	32.0	33.0	33.6	34.1	35.1	35.9
Agriculture	10.1	11.3	11.5	11.8	11.8	12.0	12.0	11.9
Industry	4.5	5.0	5.0	5.0	5.1	5.0	5.1	5.4
Manufacturing	2.7	3.1	3.1	3.1	3.1	2.9	2.9	3.0
Services	12.0	15.1	15.5	16.1	16.7	17.0	17.9	18.6
Employment (% in total)								
Agriculture	37.9	36.0	35.9	35.8	35.1	35.3	34.4	33.0
Industry	17.1	15.9	15.6	15.2	15.3	14.8	14.5	15.1
Manufacturing	10.2	9.7	9.6	9.3	9.1	8.6	8.3	8.4
Services	45.0	48.1	48.4	49.0	49.6	49.9	51.1	51.9
Employment growth (%)								
Agriculture		0.4	2.2	2.6	–0.2	2.1	0.1	–1.6
Industry		3.0	0.6	–0.2	2.3	–1.4	0.9	6.1
Manufacturing		0.6	0.6	–0.4	0.4	–4.7	–1.1	4.5
Services		3.5	2.8	4.0	3.1	2.2	5.4	3.9

Source: NSCB (2012).

Table 2: IT-BPO export revenues and employment ($ million and number of employees)

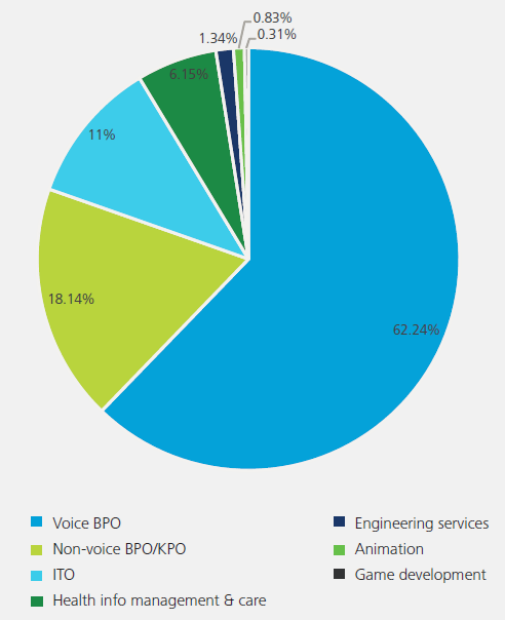
Type	2004	2005	2006	2007	2008	2009	2010	2011p	2012p
A. Voice business process outsourcing (BPO)									
Contact centers	1,024	1,792	2,360	3,600	4,100	5,000	6,100	7,400	8,700
B. Non-voice BPO and IT									
Back office	120	180	288	398	827	1,118	1,660	2,058	–
Transcription	72	70	109	137	182	187	202	277	–
Animation	52	74	97	105	120	120	142	128	132
Information technology outsourcing	170	204	272	423	601	568	725	993	1,160
Engineering service outsourcing	34	48	68	152	228	228	163	172	206
Digital content/game development	3	7	13	1	3	4.5	7	8	–
Subtotal non-voice revenue	451	583	847	1,216	1,961	2,225	2,899	3,636	4,500
Total revenue	1,475	2,375	3,207	4,816	6,061	7,225.3	8,999.0	11,036	13,200
Employment (full-time)									
A. Voice	64,000	112,000	160,000	198,000	227,000	280,000	344,000	416,000	497,000
B. Non-voice	36,500	51,250	75,575	100,953	144,965	162,164	181,182	221,929	273,000
Total direct employment	100,500	163,250	235,575	298,953	371,965	442,164	557,127	638,000	777,000

– = data not available, IT-BPO = information technology-business process outsourcing, p = provisional estimates.

Source: Mitra 2013

By 2013, IT-BPO became the biggest employer in the private sector, employing upwards of one million people and accounting for 6% of GDP (Deloitte 2015). With a CAGR of about 25% in the last decade, some analysts predict that sectoral revenue could reach $48bn, making up 20% of the global market (ibid). While tough rhetoric by President Duterte against the IT-BPO's biggest client, the United States, raised concern among industry watchers, the government has reiterated its support for the sector going forward (Rodriguez, 2016).

Chart 1: Revenue Share of IT-BPO Segments



Source: Deloitte 2015

What are the challenges to future growth?

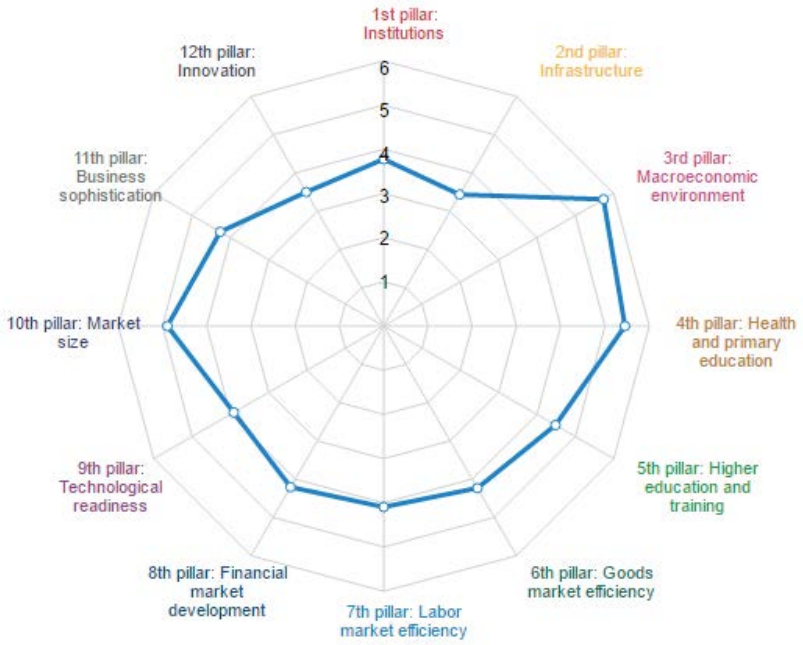
The IT-BPO sector has become a key industry in the Philippine economy over the last two decades, but there are challenges that threaten the sector's global competitiveness. According to World Bank economist Sebastián Sáez, the performance of the service sector is crucially dependent on the quality of three factors: human capital, institutions, and the telecommunications network (World Bank 2011).

Until recently, the conditions of these factors in the Philippines have been broadly amenable to the IT-BPO industry. There is a large, well educated, English-speaking workforce, and the 1995 liberalization of the telecommunications industry led to increased competition and service quality (Aldaba 2000). However, these advantages have degraded over time. In recent years, the country's service sector performance has started to lag behind its regional competitors owing to low domestic investment rates, weaknesses in governance, and poverty alleviation concerns (Mitra 2013). The Philippine Development Plan 2011-2016 is the government's marquee document identifying the priorities of the next five years, and provides a roadmap of how to achieve these goals. The report focused on economic growth for the twin goals of reducing unemployment, as well as reducing poverty in line with the Millenium Development Goals (NEDA, 2011).

The plan identified inadequate infrastructure and institutional weakness as key constraints to continued growth, and made mention of the need to tackle the above issues in order to support the ICT industry (NEDA 2011). These themes are continued in the draft chapters of the Philippine Development Plan 2017-2022 currently available; chapter 9 talks broadly about expanding economic opportunities in industry and service, while chapter 14 focuses specifically on the promotion of technology and innovation in the economy (NEDA, 2017).

The World Economic Forum's Global Competitiveness Report ranks countries' competitiveness on a scale of 1-7 according to 12 pillars, illustrated below (World Economic Forum 2015).

Chart 2: WEF Global Competitiveness Report, Philippines



Source: World Economic Forum 2015

For our purposes, we are primarily interested in pillars 1, 2 and 5. As we can see, the Philippines receive comparatively lower scores in the categories of institutions and infrastructure (which includes telecommunications and internet connectivity). Higher education and training fares somewhat better, but a score of 4.5 indicates there is room for improvement. We discuss each of these in the next section.

Issue/Hypothesis

We foresee three major challenges to the continued growth of the IT-BPO sector in the Philippines: inadequate telecommunication and internet infrastructure, a shrinking pool of sufficiently high quality human capital (due to

higher human capital requirements), and a lack of government efficiency and effectiveness in supporting the IT-BPO sector. We discuss each of these in more detail below.

Telecommunications Infrastructure

It is indicative of the speed of which technology can be made obsolete that the Philippine Institute for Development Studies made the following statement as recently as 2006 (Pasilla 2006):

> *"The Philippines is considered to have a relatively good telecommunications infrastructure, both voice and data, as compared to other countries in the Asia-Pacific region. There is redundant international connectivity, including fiber optic cable and satellite communication… There is high-quality, low-cost bandwidth that is expanding the domestic telecommunications network."*

In recent years, the earlier advances made in the Philippines towards faster internet speeds and connectivity has been eroded by a lack of investment in new technologies and infrastructure. The country now lags behind its regional neighbors, with an average download speed of 3.64Mbps, compared to the world average of 23.3Mbps (ASEAN Briefing 2015). A recent study found that internet speeds in the Philippines are the second slowest in Asia, behind only Afghanistan (Gonzales 2015, ABS-CBN 2015). Quite apart from the difficulties this creates for the average internet user in the Philippines, it also creates challenges for e-commerce and for those IT-BPO industries that rely on investment in communications technology and broadband in order to remain competitive. The World Economic Forum's Global Competitiveness Report ranks the Philippines' electricity and telephony infrastructure as a 3.5/7, or 95th globally (of 140 countries) (World Economic Forum 2015). Slow connectivity can also dissuade investors from doing business in the country, dampening further investment. Thus, there is a need to prioritize investment in the internet and communication infrastructure in the Philippines, if it is to maintain its competitiveness in IT-BPO.

Human Capital Requirements

The literacy rate in the Philippines is currently over 93%, compared to the world average of 84%, and has the third largest English-speaking population in the world after the US and the UK (UNESCO Institute for Statistics, 2013). But while the workforce remains one of high literacy and overall education, the continued evolution and growing complexity of the IT-BPO industry means that increasing levels of technological literacy and specialized IT know-how are required. The World Economic Forum's Global Competitiveness Report ranks the Philippines' quality of education as 4.4/7, or 44/140 globally (World Economic Forum 2015).

In the 2000s, the government provided some education grants for the training of service sector employees, including the IT-BPO sector, overwhelmingly for call centers (Magtibay-Ramos, Estrada and Felipe 2007). However, with the industry moving towards higher-value sub-sectors, a focus on call centers may be an outdated approach that requires renewal. By working with industry groups to plan for future needs, a more efficient and effective approach to this area may be implemented.

Government Inefficiency

Over the last two decades, the government has recognized the growing importance of the IT-BPO industry, and made efforts to support it as it has matured. In 2001, the government formed the Information Technology and E-Commerce Council (ITTEC) to provide policy leadership to the government, with the objective of developing the country as a global hub for e-services. This was followed in 2005 by the launch of the Philippine Cyberservices Corridor, which comprised of a number of urban centers in different cities to provide numerous IT-BPO services (Magtibay-Ramos, Estrada and Felipe 2007).

Nonetheless, progress appears to have slowed down since then. The Commission on Information and Communication Technology (CICT) was formed in 2004, and intended to be the primary administrative entity to regulate and support the development of the ICT sector. Numerous bills were debated in Congress from 2008-2011 that would have transformed it into an executive department, but it was eventually abolished in 2011 by executive order (The Government of the Philippines 2011). This lead to deep discontent by the IT-BPO trade associations, and a combined statement was released voicing their dissatisfaction with the decision (BPAP et al. 2011):

> *"We were disappointed that EO 47 was issued without the benefit of extensive stakeholder consultation, as we believe that this would have been highly beneficial to the development and execution of public policy on the key ICT sector… We call upon our government to engage in deeper collaborative dialogue with all stakeholders before undertaking further major reforms that critically affect our sector. Unless we strengthen our Public-Private Partnership with the government, we will have great difficulty achieving our goal of generating hundreds of thousands of new jobs in the next few years."*

Beyond the narrow scope of the IT-BPO sector, the Philippines faces governance challenges common to many countries in the region and the developing world. Potential investors in IT-BPO will be concerned about corruption, criminality, and the physical security of the staff and property services (Magtibay-Ramos, Estrada and Felipe 2007). The Global Competitiveness Report 2016 gives the Philippines a score of 3.6/7 for its public institutions (ranked 77/140 globally), suggesting there is much room for improvement (World Economic Forum 2015).

In this paper we propose two policies to stimulate the IT-BPO sector. The first two policies directly impact the sector by increasing capital and labor productivity through investment in telecommunication infrastructure and targeted training respectively. The final policy takes an indirect approach, by increasing the efficiency and effectiveness of the government sector in a 'rising tide lifts all boats' approach. Each of these policy shocks is discussed in the next section.

Data and Methodology

Literature Review

For over 30 years CGE models have increased in popularity, and they are now a standard tool in economic analysis. Improvements in information technology and model specifications have meant that CGE models are less costly to run, and provide more benefits as they increase in flexibility and complexity. They have been used to examine the effects of shocks to the Philippine economy (Habito 1986, Briones et al. 2006), with some success. CGE models have also been used to study the service sector in other economies (Jung and Thorbecke 2003, Narayan 2004, Cutler and Davies 2008). However, there appears to be little literature on the use of CGE models to study the IT-BPO industry in the Philippines in particular. Thus, this study attempts to shine a light on this sector of the Philippine economy, using a CGE modeling approach.

The Bangko Sentral ng Pilipinas (BSP, the Philippine central bank) follows a similar process of many other central banks by not differentiating BPO activities from other service business (Padilla 2006); we therefore have a lack of granularity in the data. This is translated in the social accounting matrix (SAM) that we used, where business services falls under the 'trade and transportation' account. Therefore, in our analysis we have little option but to model the effect on the 'trade and transportation' as a whole.

Model Description and Assumptions

We conducted this analysis using an updated version of Lofgren, Harris and Robinson's standard CGE model (2002) prepared by Pineiro and Robinson.

The CGE model has three components: first, payments made between agents are shown in the SAM. The second component is the equations that represent the behavior of the different institutions present. Third, the system of constraints that have to be satisfied by the whole system are represented (Morley and Pineiro, 2015).

We assume that producers maximize profits under constant returns to scale and perfect competition. There are two factors of production: labor and capital. A constant elasticity of substitution (CES) production function provides the relationship between production and factor inputs; it allows producers to substitute labor and capital until they reach the point where the marginal revenue of each factor equals the factor price. Producers also decide the amount of intermediate inputs used in production, assuming fixed shares that specify the appropriate amount of intermediate inputs per unit of output and factor input. The price of output depends on the cost of labor and capital and intermediate inputs.

The model we use is static and operates under conditions of perfect competition. Wages are sector-specific, and unemployment is allowed to exist. Government operates with both revenues and expenditures and may run a

surplus or deficit. World prices are exogenous, and imperfect substitutes of import and export goods exist. Producers are assumed to maximize profits subject to a CES function; households maximize utility subject to budget constraints.

The model satisfies Walras' law: if a set of markets is in equilibrium the last (n-1) is also in equilibrium. Household income is allocated in fixed shares to S-I, consumption, and taxes. The model is homogenous of degree zero in prices. CPI is fixed, and prices are normalized to ensure only one solution exists.

The presence of intermediate demand means that we have a nested production function. The aggregate value added is a Cobb-Douglas production function, while the intermediate is a Leontief function. The aggregate production function is Leontief in form. Constant Elasticity of Transformation (CET) is assumed for producers. Users demand the composite commodity based on the relative prices of domestic and imported goods, which are imperfect substitutes – known as the Armington approach.

Closures

For our government account closure, we allow government savings to be flexible or endogenous to the model. For the current account closure, we allow the exchange rate to be flexible, while foreign savings are exogenous to the model. In the labor markets, we assume full employment and flexible wages. Capital is also fully employed, with profit rates endogenous. For the government revenues closure, we fix tax rates as exogenous. In our savings-investment closure, we allow savings to be driven by investment (IDS), rather than vice versa. Finally, for our numeraire, we select CPI instead of the exchange rate, allowing us to track changes in real prices.

SAM Structure: Highlights

We use the SAM provided by Robinson (2013), a comprehensive SAM of the Philippine economy for 2011. This provides a better idea of the overall structure of the economy, and the importance of the service sector within that.

The Philippine economy is predominantly non-agricultural: less than 8% of all production is in agricultural commodities. Of the other 92%, the biggest individual sector is trade and transportation (32%). 99% of Philippine exports are non-agricultural as well. The biggest export sector is manufacturing, with 48.6% of total export value. This is followed by services with 32.6%. Imports tell a similar story: 98.7% of total import value is non-agricultural, with manufacturing making up just over 50%. Services make up 18% of total import value. The service sector is not particularly export or import heavy: 15% of the total services output is exported, and 9.9% is imported.

Different sectors of the economy vary in their factor-intensiveness. Services are capital intensive: 74.6% of the factor share is for capital, with just 25.4% for labor (we lack the granularity in the data to know if this ratio holds true for IT-

BPO, and so we must assume this to be the case). The government services sector, on the other hand, is highly labor intensive, with an 85.6% share for labor and just 14.4% for capital. Neither sector has any share of total land or livestock factors. In terms of total factor shares in the economy, the service sector has a 32.5% share of total labor, more than any other activity. It also has a 54.4% share of capital. Overall, the service sector has a 45.3% share of total factors. Thus when trying to boost GDP, focusing on services is a good place to start: when 45% of your total factors are employed in a single (albeit widely defined) industry, it is logical to look there for productivity gains. In terms of consumption, 48% of total household consumption is spent on services, followed by agro-processing commodities (31%). For intermediate goods, this changes to 31.5% for services, followed by 24.7% for manufactured commodities.

Policy Scenarios

Scenario I: Investment in the Telecommunications Infrastructure

Our first scenario deals with what we believe is the most pressing issue relating to the IT-BPO industry: the telecommunication infrastructure. By investing in telecommunications frameworks, the Philippines can develop faster internet speeds and bandwidth, more reliable networks, more innovative e-commerce platforms, and more advanced data security. In practical terms, these improvements would increase total factor productivity from both the capital and labor side: the internet infrastructure is a capital good, but faster internet means individual workers are able to be more productive in their work. To achieve this increase in productivity there must be an increase in the investment term.

We expect an increase in productivity to lead to an increase in sectoral supply, and thus a fall in the domestic price. The fall in price leads to an increase in demand, and a fall in imports as consumers switch away from the imported service. Exports would rise as well, as increased production at a lower price would make it more profitable to sell the service abroad. Government revenue would increase, as increased factor rents and thus household incomes would lead to higher tax revenue. Foreign savings would also increase, as we expect the increased investment necessary to pay for this to be supplied by foreign savings.

Scenario II: Government expenditure in targeted training programs

For the second scenario, we advocate specific training programs by the government that target high value and growing subsectors in the IT-BPO industry, in order to increase human capital and thus labor productivity. Note that we specifically propose vocational training as opposed to investments in or amendments to primary and secondary education; the effects of the latter would be more diffuse less immediate, which is contrary to our objectives. Caution is advised, however; unlike the previous scenario, this is exclusively a labor productivity scenario. According to the model, labor has only a 25% share of the factors in this sector. Therefore, the increase in productivity that we

propose must necessarily be lower than our first scenario. Government spending must increase, as we envision this initiative to be government-led. This increase in government spending is to be funded by foreign savings.

We expect a similar adjustment mechanism and outcome as the previous scenario, as described in the previous section. There are two major differences we expect to impact results: (i) funding for the programs comes from government expenditure here, rather than investment. Since investment in the SAM is not directed at the services sector specifically, we would expect more broad-based changes in Scenario I compared to Scenario II, where we'd expect a more specific increase in government services GDP; (ii) Scenario I is projected to impact labor and capital productivity, while Scenario II is projected to impact labor productivity only.

Methodology

For each scenario, we model the impacts of a 'moderate' and 'strong' change in order to provide some sensitivity analysis. This allows us to study the different effects of when the increase in productivity is primarily a result of government spending versus foreign investment.

Results

We detail the relevant outputs from the model for each of the scenarios below. Simulation A refers to the moderate telecommunication infrastructure scenario, while Simulation B refers to the 'strong' telecommunication infrastructure scenario. Similarly, Simulation C refers to the moderate human capital scenario, while Simulation D refers to the 'strong' human capital scenario.

We reproduce the results below, and discuss some of the key findings as compared to our expectations from the previous section. We first look at the overall impact on GDP, before digging into detail on factor wages, prices, imports and exports, and consumption, with a focus on the services sector but also with an eye on other major sectors in the economy.

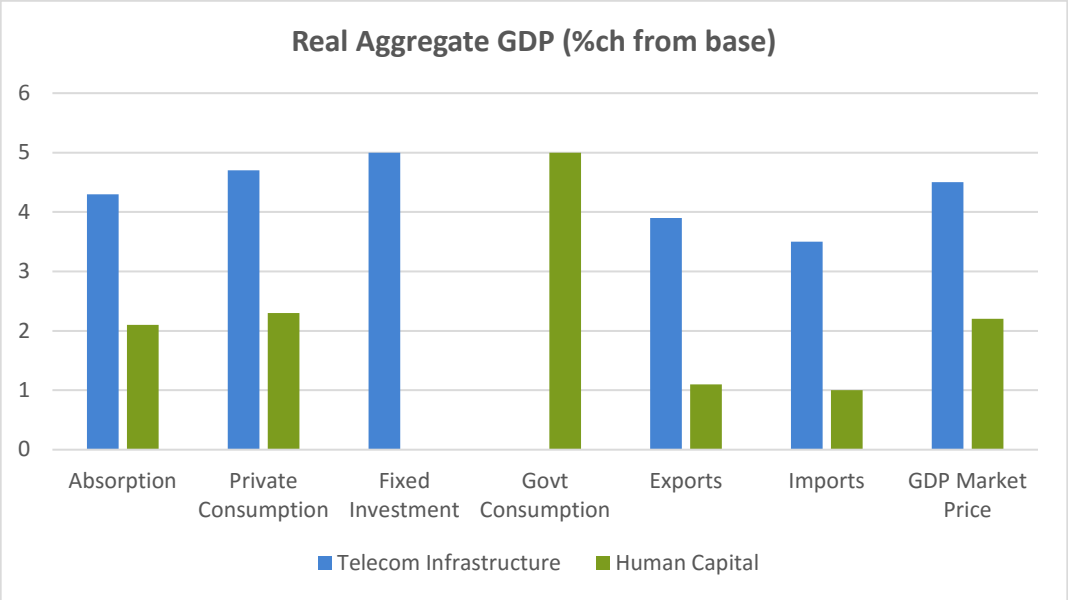
Table 3: Scenarios and Results – in percentage changes and percentage changes with respect to the base respectively

	Telecom Infrastructure (Sc I)		**Human Capital (Sc II)**	
Scenario	**Sim A**	**Sim B**	**Sim C**	**Sim D**
Shock (%change):	Moderate	Strong	Moderate	Strong
Investment adjustment factor	5	15		
TFP Trade Sector	10	30	5	15
Govt. Adjustment Factor			5	15
Results:				
Real Aggregate GDP:				
Absorption	4.3	12.6	2.1	6.3

Private Consumption	4.7	13.6	2.3	6.9
Fixed Investment	5	15		
Govt Consumption			5	15
Exports	3.9	12	1.1	3.4
Imports	3.5	10.8	1	3.1
GDP Market Price	4.5	13	2.2	6.5

Source: author's worksheets

Figure 3: Real Aggregate GDP, percentage changes from the base



Source: author's worksheets

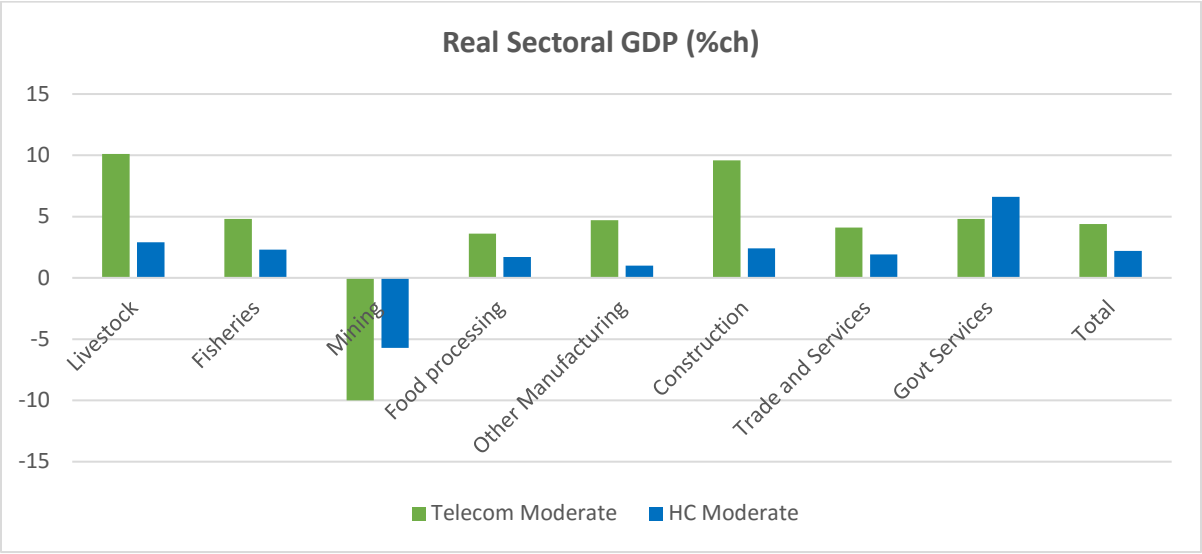
The first part of the table above shows the details of which parameters were shocked, and to what magnitude (in percentage change terms). The second part of the table shows the percent changes in real aggregate GDP for each scenario. Looking at the different categories – total absorption, private consumption, government consumption, imports and exports, fixed investment, and GDP market price – we can see that scenario I appears to have a bigger positive impact than scenario II on average, which tallies with our earlier expectations. We also get a wider spread across the two simulations of scenario I than scenario II. The chart makes it clear that, in terms of aggregate GDP components, the telecommunications investment scenarios have the largest individual impact.

Table 4: Real Sectoral GDP and GDP Results – in percentage changes with respect to the base

Scenario	Sim A	Sim B	Sim C	Sim D
Real Sectoral GDP (Activities):				
Livestock	10.1	30.7	2.9	8.2
Fisheries	4.8	13.8	2.3	6.6
Mining	-10	-25.3	-5.7	-15.7
Food Processing	3.6	9.7	1.7	4.8
Other Manufacturing	4.7	11.2	1	2.1
Construction	9.6	29.6	2.4	7.1
Trade and Services	4.1	12.5	1.9	5.6
Govt Services	4.8	13.9	6.6	20.3
Total	4.4	13	2.2	6.6
Real Agg/Non-Agg GDP Results:				
Agricultural Activity	5.1	14.8	1.9	5.4
Non-Agricultural Activity	4.4	12.8	2.3	6.7
Exch. Rate	0.9	1.9	0.5	1.1
Household income	4.8	13.6	2.5	7.3
Household consumption expenditure	4.5	12.5	2.3	6.6

Source: author's worksheets

Figure 4: Real Sectoral GDP, percentage changes from the base



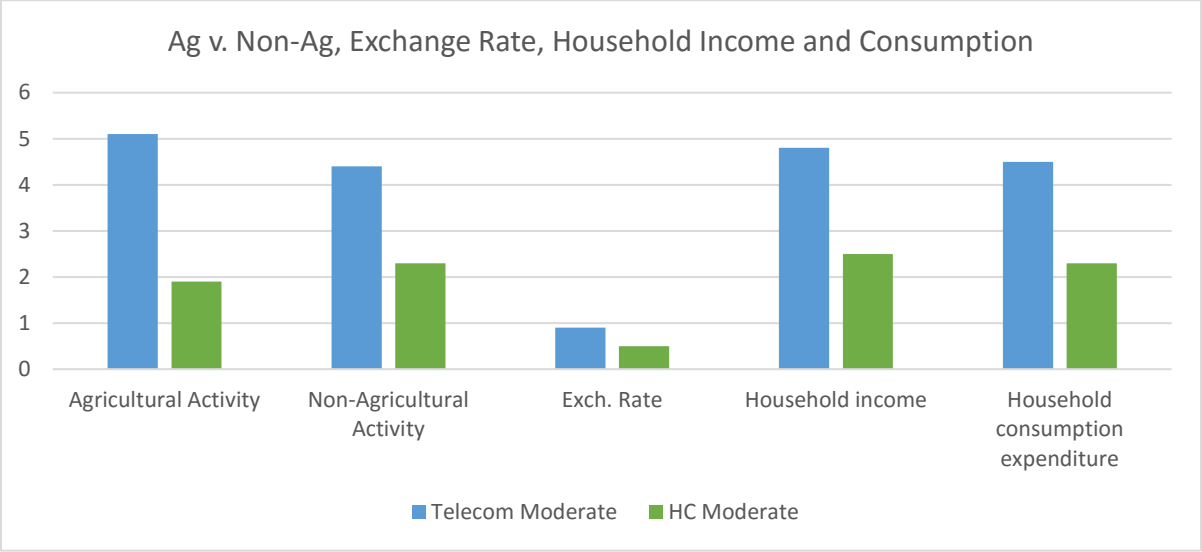
Source: author's worksheets

The table above shows us real GDP broken down by sector. We find that the services component of GDP rises by 1.9% in the moderate human capital shock, compared to 4.1% in the moderate telecom shock. Construction received the most investment in the baseline, and we can see here that construction benefits greatly in this shock, by 9.6% in the moderate scenario. The big loser in both cases is the mining activity, falling 10% and 5.7% respectively.

To understand why some sectors perform better than others, it is important to understand the interlinkages between each sector, and how each shock affects them. In both scenarios, we are increasing total factor productivity in the services sector, albeit through different mechanisms. This means that the services sector produces more efficiently, lowering prices and increasing wages to capital and labor, and therefore to households. We thus expect this to filter to the rest of the economy through two distinct channels. First, industries that rely on the services sector more will benefit disproportionally greater than those who rely on the services sector less. Second, industries that receive greater payments from household will benefit more than those that receive less. These include food processing, manufacturing, and services.

The mechanism through which TFP is increased also matters. Industries that rely on investment as a source of income will benefit more in scenario I – construction and manufacturing, for example, are heavily dependent on savings and investment, and so we would expect their component of GDP to increase more in scenario I than scenario II. Government services, on the other hand, would benefit more in scenario II, where TFP is boosted through government spending instead.

Figure 5: Agricultural vs Non-Agricultural GDP, exchange rate and household income and consumption, percentage changes from the base



Source: author's worksheets

We find that the agricultural sector as a whole grows more in scenario I compared to the non-agricultural sector, which is due to the effects of increasing infrastructure investment, which benefits all sectors in the model. Both

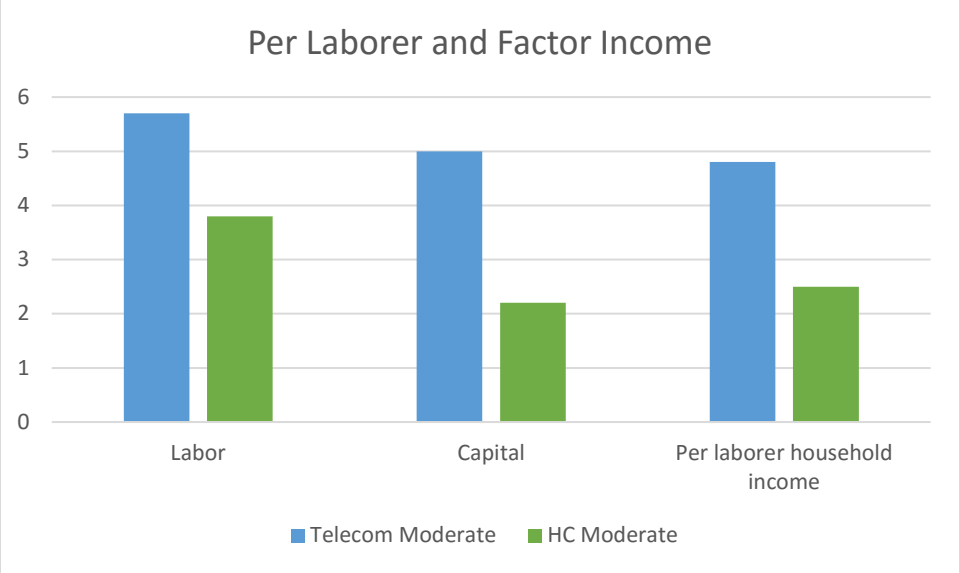
household income and household consumption expenditure increase more in scenario I (4.9% and 4.5%) than in scenario II (2.5% and 2.3%). In all cases, we see some slight currency depreciation.

Table 5: Real factor wages – in percentage changes with respect to the base

Scenario	Sim A	Sim B	Sim C	Sim D
Real Wages:				
Labor	5.7	16	3.8	11.2
Land	3.9	10.2	1.9	5.2
Livestock	11.5	35	3.4	9.5
Capital	5	14.1	2.2	6.3
Per laborer household income	4.8	13.6	2.5	7.3

Source: author's worksheets

Figure 6: Per laborer and factor income, percentage changes from the base



Source: author's worksheets

We look next at factor wages. An increase in the investment adjustment factor, as we see in scenario I, has a strong impact on all factor wages, because labor and capital are now more productive. Labor wage increases by 5.7% in the moderate telecom scenario, and capital increases by 5%. The corresponding figures for scenario II are 3.8% and 2.2% respectively. Higher wages for labor leads to an increase in household income, and thus increased household consumption, which we saw earlier.

Higher wages lead to higher prices as well, as producers are paying more to their factors of production – land and labor, as well as capital and livestock where applicable. This is borne out by the average output price of commodities

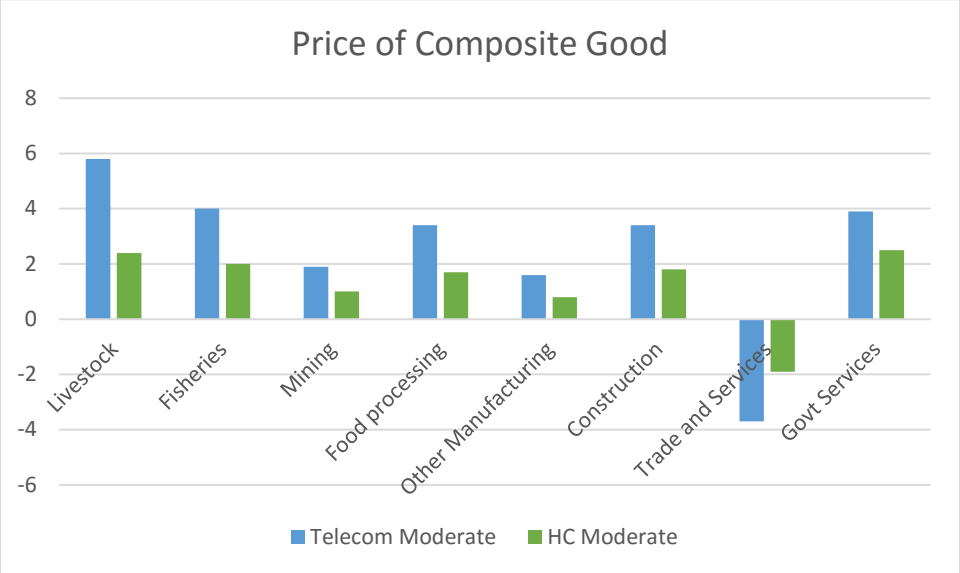
and the price of the composite good or service (as the growth rates of each are almost identical, we provide data only on the latter below). We see this in the table below, with the exception of the commodities where total factor productivity was increased. In those cases, higher productivity has meant that supply could be increased, reducing the domestic price. Since world prices are fixed and exogenous to the model, the composite price falls.

Table 6: Prices – in percentage changes with respect to the base

Scenario	Sim A	Sim B	Sim C	Sim D
Price of composite good:				
Livestock	5.8	16.9	2.4	6.8
Fisheries	4	11.3	2	5.8
Mining	1.9	4.6	1	2.5
Food Processing	3.4	9.4	1.7	4.9
Other Manufacturing	1.6	4.2	0.8	2.3
Construction	3.4	9.4	1.8	5.4
Trade and Services	-3.7	-10.3	-1.9	-5.5
Govt Services	3.9	11.1	2.5	7.5

Source: author's worksheets

Figure 7: Prices, percentage changes from the base



Source: author's worksheets

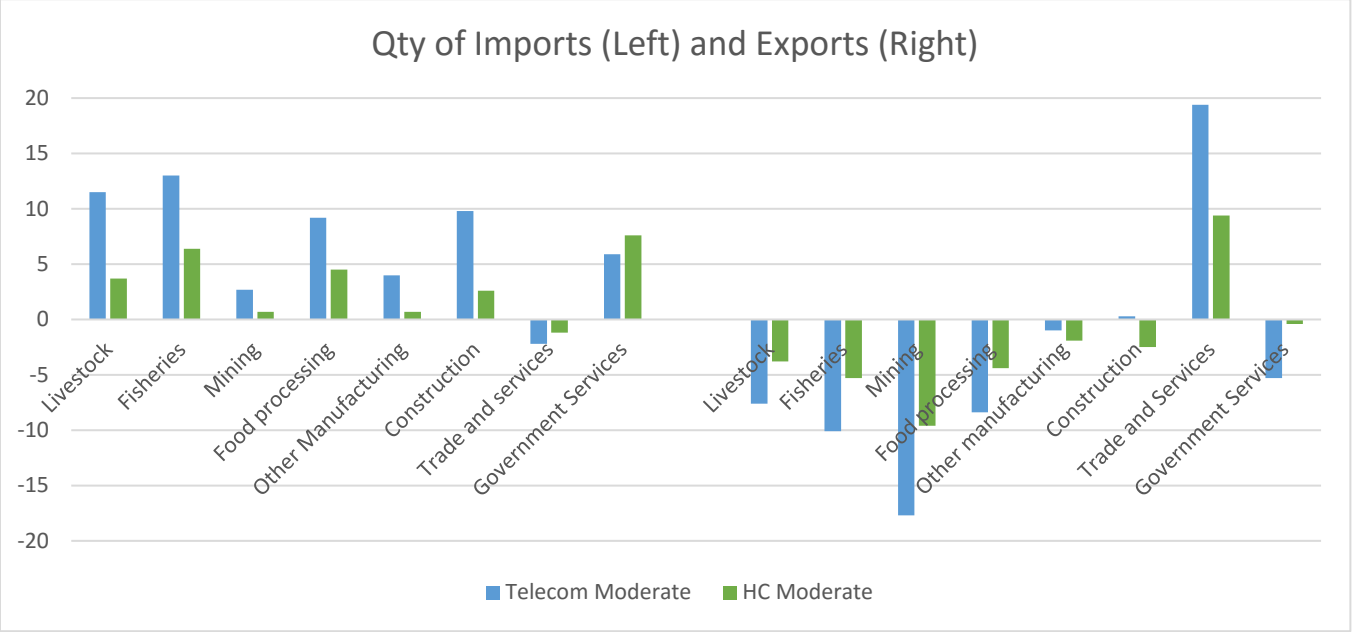
In cases where productivity has not changed, the price of the composite good increases. This is because higher wages for factors of production necessitate an increase in domestic prices (world prices remain unchanged), raising the price of the composite good. We would expect this to mean an increase in the imports of these goods, as world prices are comparatively less expensive. Since productivity in the service sector has increased, the domestic price of the composite good has fallen. Thus, we would expect a fall in imports instead, and a rise in exports as selling on the world market becomes more attractive (due to lower comparative domestic prices). The results on imports and exports is below:

Table 7: Imports and Exports – in percentage changes with respect to the base

Scenario	**Sim A**	**Sim B**	**Sim C**	**Sim D**
Qty of imports:				
Livestock	11.5	37.4	3.7	11.1
Fisheries	13	43.1	6.4	20.1
Mining	2.7	6.9	0.7	1.9
Food Processing	9.2	29.3	4.5	14
Other Manufacturing	4	12	0.7	2.2
Construction	9.8	31.7	2.6	8.1
Trade and services	-2.2	-5.1	-1.2	-3.2
Government Services	5.9	18.4	7.6	24.1
Qty of exports:				
Livestock	-7.6	-20.8	-3.8	-10.8
Fisheries	-10.1	-27.6	-5.3	-15.3
Mining	-17.7	-42.6	-9.6	-25.6
Food Processing	-8.4	-23.7	-4.4	-12.8
Other manufacturing	-1	-6	-1.9	-6.5
Construction	0.3	0.3	-2.5	-7.5
Trade and Services	19.4	61.6	9.4	29.1
Government Services	-5.3	-15.1	-0.4	-1.7

Source: author's worksheets

Figure 8: Imports and Exports – in percentage changes with respect to the base



Source: author's worksheets

Our expectations are realized in both the service sector and other sectors: for services, we see a small drop in imports (which were not large in absolute terms to begin with), and a sharp rise in exports. We see more than double the increase in scenario I than scenario II in all scenarios.

For the non-service sectors, we see imports rise in both shocks and exports fall. In some cases the movements are large in percentage change terms: fisheries and livestock see rises in imports of 11.5% and 13% respectively in the moderate telecom scenario, for example.

Overall composite production of goods and services is mixed: some sectors see an increase in production – services, government and construction in particular – and others see a fall in production – fisheries, livestock, and mining most of all. This reflects a structural shift in the economy brought about by increasing labor productivity in services and increased investment and government spending respectively. Overall GDP increases, but not all sectors are winners.

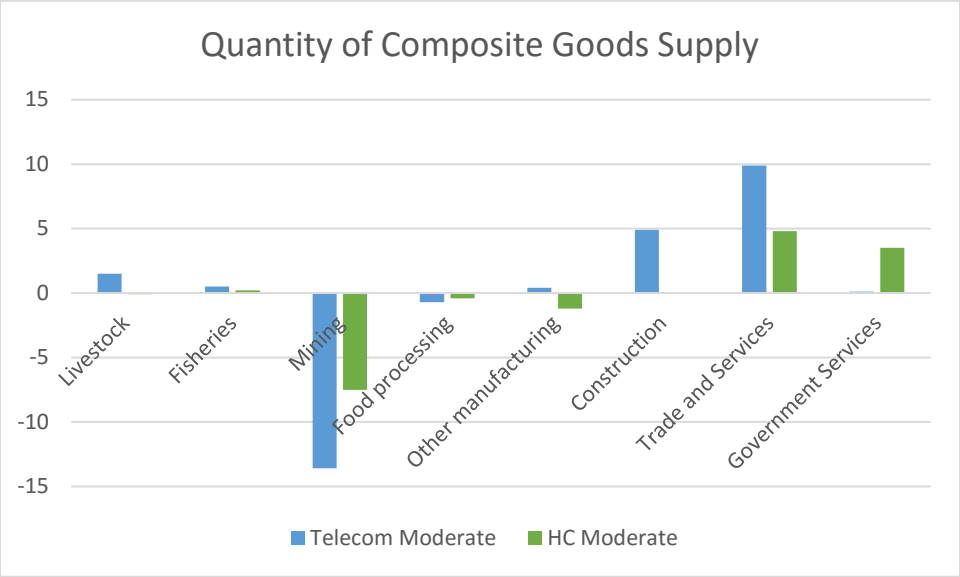
Table 8: Quantity of composite goods supplied– in percentage changes with respect to the base

Scenario	**Sim A**	**Sim B**	**Sim C**	**Sim D**
Qty of composite goods supply:				
Livestock	1.5	4.3	-0.1	-0.4
Fisheries	0.5	1.1	0.2	0.5
Mining	-13.6	-33.5	-7.5	-20.2
Food Processing	-0.7	-2.5	-0.4	-1.3
Other manufacturing	0.4	-1.3	-1.2	-4.2

Construction	4.9	14.8	0	0
Trade and Services	9.9	30	4.8	14.5
Government Services	0.1	0.2	3.5	10.4

Source: author's worksheets

Figure 9: Quantity of composite goods supplied– in percentage changes with respect to the base



Source: author's worksheets

Supply of services increases by about 9.9% and 4.8% in moderate scenarios I and II respectively. This is positive, and in line with our expectations and results discussed earlier. For other sectors, the results are mixed: livestock sees small increases in output with scenario I but slight decreases in scenario II. Mining was the big loser, seeing falls of almost 13.6% and 7.5% in output in scenarios I and II respectively. Other sectors, on the other hand, benefit from the shocks. Construction sees a 4.9% increase in output in moderate scenario I owing to increased investment, and fisheries saw slight increases in output in both shocks.

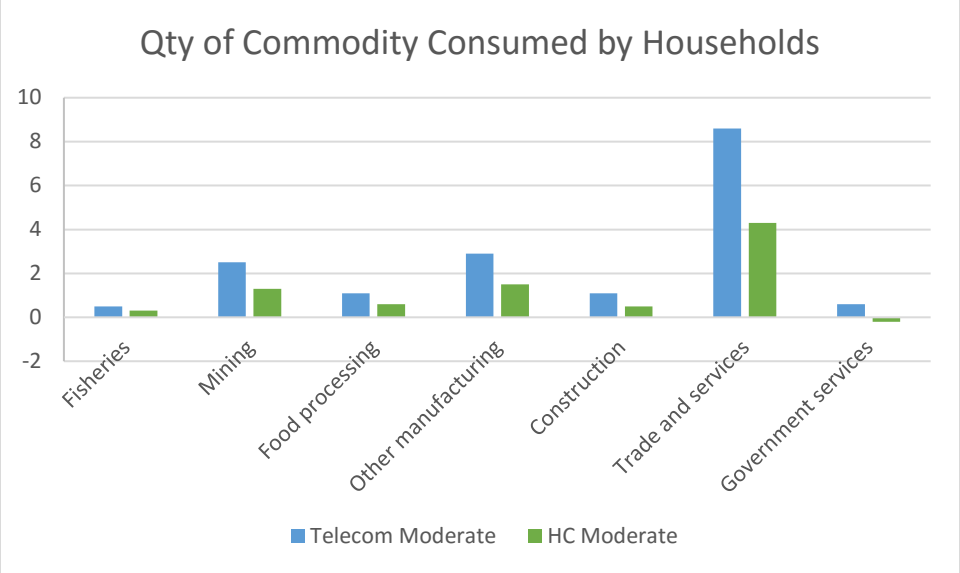
Table 9: commodities consumed – in percentage changes with respect to the base

Scenario	**Sim A**	**Sim B**	**Sim C**	**Sim D**
Qty consumed of commodity by household:				
Livestock	-1.2	-3.8	-0.1	-0.2

Fisheries	0.5	1.1	0.3	0.7
Mining	2.5	7.5	1.3	3.9
Food Processing	1.1	2.8	0.6	1.6
Other manufacturing	2.9	7.9	1.5	4.2
Construction	1.1	2.8	0.5	1.1
Trade and services	8.6	25.3	4.3	12.8
Government services	0.6	1.2	-0.2	-0.8

Source: author's worksheets

Figure 10: commodities consumed – in percentage changes with respect to the base



Source: author's worksheets

Despite the fall in composite good supply in some sectors, household consumption increases healthily in all cases despite increases in the composite goods price, owing to higher household income, save for a few sectors such as livestock. Higher income from higher factor prices has driven an increase in consumption by households. Much of this increase is of imported commodities rather than the domestically produced variety, as we saw earlier. Service consumption in particular rose, by 8.6% and 4.3% in moderate scenarios I and II respectively.

Conclusions and Recommendations

The IT-BPO sector has already been targeted by Philippine policymakers as a growth sector, and one to anchor the country's economy on. This makes sense on many levels: the country has a small agricultural base, a large and well educated English-speaking population, and an existing physical and governance infrastructure to take advantage of the growth in this sector. The policy shocks we examine in this paper build on these, and encourage the government

to reorient itself towards this goal even further. By using the Lofgren et al. (2002) standard CGE model, we examined the effects of two direct shocks to service sector productivity: one that utilized foreign savings to fund investment in vital infrastructure, and the other that focused on government expenditure to fund targeted human capital creation programs instead. We found that both had the intended effect of increasing service sector output and boosting GDP, to different degrees. The choice of increasing investment versus government spending translated to different impacts to secondary sectors: those which had previously higher levels of investment tended to benefit in scenario I, while the government's contribution to GDP increased in scenario II.

Finally, it is important to remember that in our modeled shocks, some sectors see an increase in production – services, government and construction in particular – while others see a fall in production – fisheries, livestock, and mining most of all. This reflects a structural shift in the economy brought about by increasing labor productivity in services and increased investment and government spending respectively. Overall GDP increases, but not all sectors are winners. The shifting of importance of the engines of an economy inevitably leave some behind, and while aggregate gains are positive, those who are employed in the 'losing' sectors may fall through the cracks and not enjoy the gains of increased prosperity. Policymakers must be cognizant of this fact, and implement parallel programs to ensure that those employed in such sectors are given adequate support and retraining should they be negatively impacted: it is imperative that there exists a social safety net that allows the 'losers' of such a process to be gainfully reemployed and be a part of the new engines of growth.

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